Metallovedeniye i termicheskaya obrabotka stali AID 657 - X

TEXT DATA

Coverage: The elements of metallography are discussed in the introduction to give comprehensive practical information on the recognition and avoidance of certain defects in pig iron, steel, and nonferrous metal alloys. Then the common defects, flaws, etc. in semi-finished metals after their annealing, tempering or hardening are minutely described and illustrated with pictures and diagrams. A brief outline follows of various processes of steel treatments, the nitriding, cyaniding, of various alloys such as nickel steel, chrome steel, etc., and of high speed steel, corrosion-resisting steel, and non-ferrous metal alloys. All data are presented with a view to conveying the outward and intrinsic characteristics of metals and their usage. The chemical and technical data on metals given in diagrams and tables, are used for better fulfillment of the aims set in the manual. All data are limited in scope to fit the purpose of the book.

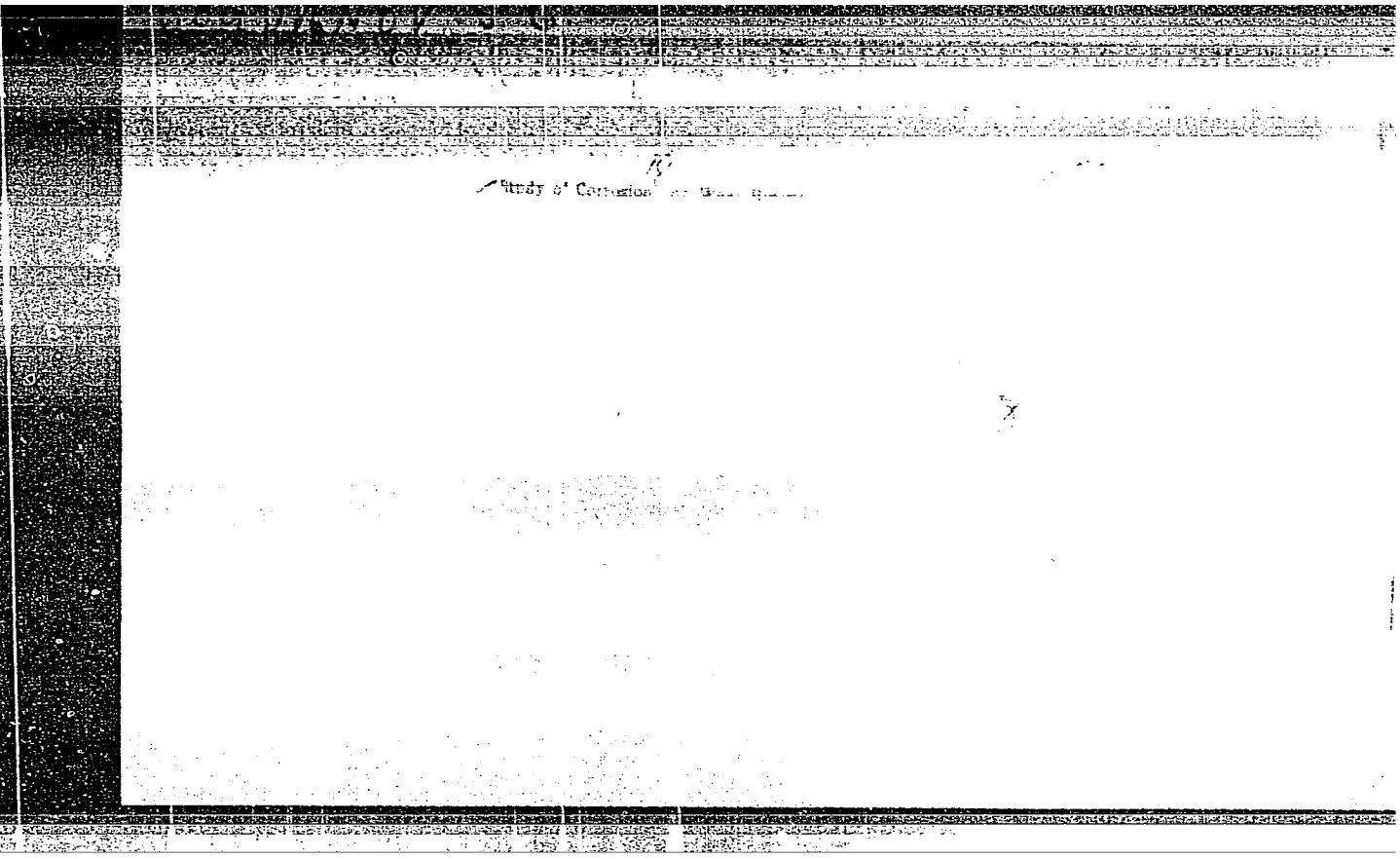
Table of Contents

Metallovedeniye i termicheskaya obrabotka stali AID 657 - X

Metallovedeniye i termicheskaya obrabotka stali AID 657 - X

Metallovedeniye i termicheskaya obrabotka stali AID 657 - X

No. of References: 28 Russian, 1933-1949.
Facilities: Russian scientists and engineers distinguished in the field of metallurgical progress are mentioned in the text.



BOGDANOV, S.

Products may be identical, but the amount of labor that goes into them varies. Sots.trud no.2:117-118 F '56. (MLRA 9:7)

1.Nachal'nik otdela truda i zarplaty Leningradskogo elektromekhanicheskogo zavoda.
(Electric meters)

BOGDANOV, S. G., DOCENT

Steel - Heat Treatment

Strengt ening frogings during the cooling in thermal chambers, Vest. mash., 32, no. 4, 1952.

9. Monthly List of Russian Accessions, Library of Congress, October 1952 Uncl.

1. BOGDANOV, S. G.

2. USSR (600)

4. Plasticity

7. Plasticity of aluminized layer in hot and cold state, Vest.mash. 32 No. 7, 1952.

9. Monthly List of Russian Accessions, Library of Congress, February 1953. Unclassified.

Bogdanov, S. G.

14687 Hot and Cold Ductility of Calorized Coatings. S. G. Bogdanov. *Henry Brutcher Translation No.* 3330, 8 p. (Abridged from *Vestnik mashinostroeniya*, v. 32, no. 9, 1952, p. 48-54.) Henry Brutcher, Altadena, Calif.

62

Aluminum-impregated steel [illegible], hot worked without scaling or other damage, show increased resistance to corrosion by water, air (ordinary and elevated temperatures), and performance under various conditions. Tables, diagram, micrographs, photographs.

BOGDANOV, S.G., kandidat tekhnicheskikh nauk, dotsent.

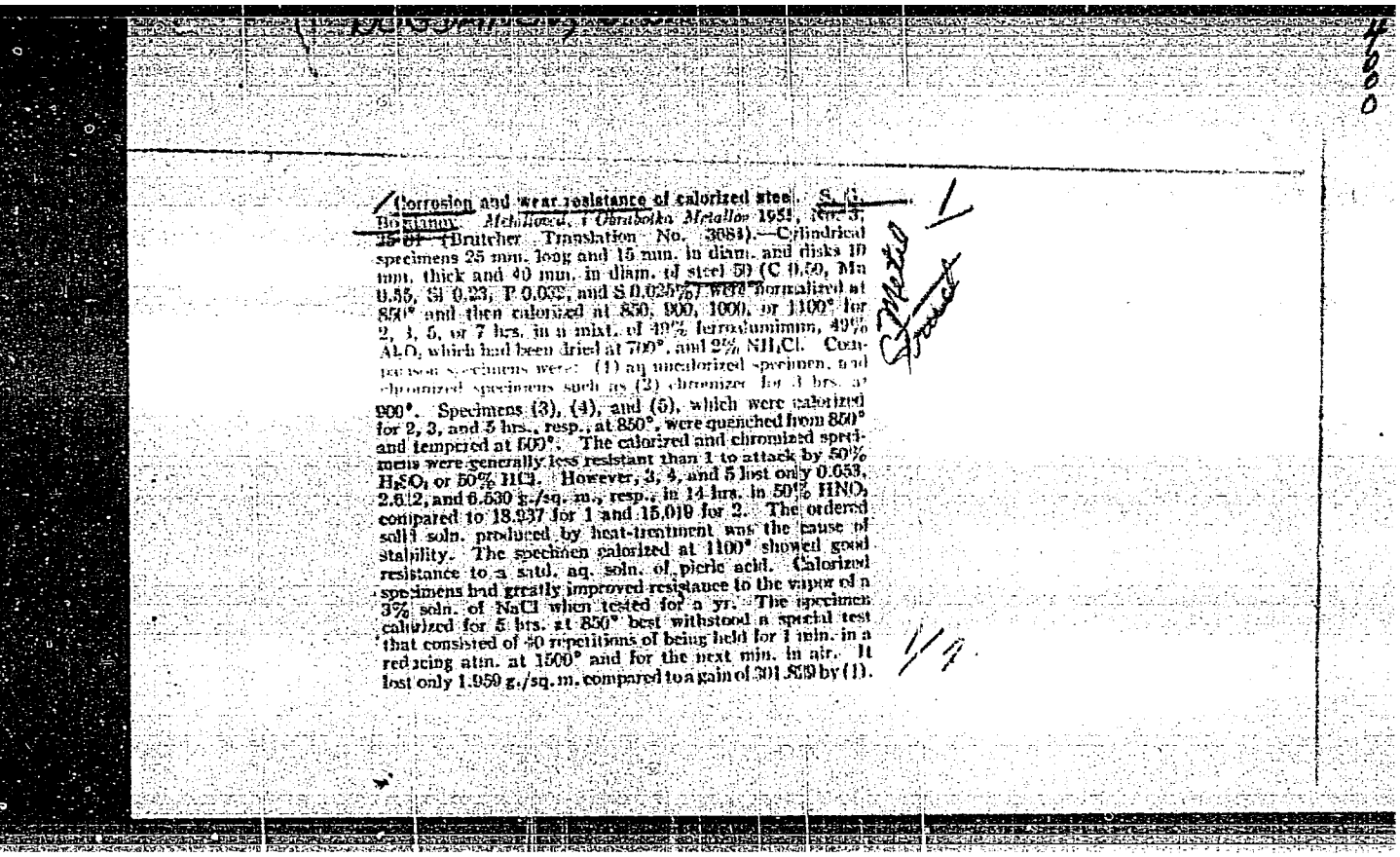
Increased strength of steel at various loads, tempered by the heat of rolling. Vest.mash. 33 no.3:39-41 Mr '53. (MLRA 6:5)
(Tempering) (Steel)

BOGDANOV, S. G.

BOGDANOV, S.G., kandidat tekhnicheskikh nauk; KUNYAVSKIY, Kh.N., kandidat tekhnicheskikh nauk, retsenzent; KORYUKOV, M.I., kandidat tekhnicheskikh nauk, nauchnyy redaktor; PETERSON, M.M., tekhnicheskiy redaktor

[The metallography and heat treatment of steel] Metallovedenie i termicheskaia obrabotka stali. Izd. 2., perer. i dop. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroit. i sudostroit. lit-ry, 1954. 302 p. (MLRA 7:9)

(Steel) (Cast iron)



Corrosion and wear resistance of calorized steel. S. G. Bogdanov. *Mekhanizat. i Obrabotka Metallov* 1951, No. 3, 25-27 (Brutcher Translation No. 3083).—Cylindrical specimens 25 mm. long and 15 mm. in diam. and disks 10 mm. thick and 40 mm. in diam. of steel 50 (C 0.50, Mn 0.55, Si 0.23, P 0.03%, and S 0.025%) were normalized at 850° and then calorized at 850, 900, 1000, or 1100° for 2, 3, 5, or 7 hrs. in a mixt. of 49% ferroaluminum, 49% Al_2O_3 which had been dried at 700°, and 2% NH_4Cl. Comparison specimens were: (1) an uncalorized specimen, and chromized specimens such as (2) chromized for 3 hrs. at 900°. Specimens (3), (4), and (5), which were calorized for 2, 3, and 5 hrs., resp., at 850°, were quenched from 850° and tempered at 600°. The calorized and chromized specimens were generally less resistant than 1 to attack by 50% H_2SO_4 or 50% HCl. However, 3, 4, and 5 lost only 0.053, 2.612, and 6.530 g./sq. m., resp., in 14 hrs. in 50% HNO_3 compared to 18.937 for 1 and 15.019 for 2. The ordered solid soln. produced by heat-treatment was the cause of stability. The specimen calorized at 1100° showed good resistance to a satd. aq. soln. of picric acid. Calorized specimens had greatly improved resistance to the vapor of a 3% soln. of NaCl when tested for a yr. The specimen calorized for 5 hrs. at 850° best withstood a special test that consisted of 80 repetitions of being held for 1 min. in a reducing atm. at 1500° and for the next min. in air. It lost only 1.950 g./sq. m. compared to a gain of 301.859 by (1).

Boyarkov, S. G.

On being heated in air at 900° (5) gained only 0.652 g./sq. m. in 7 hrs. compared to 90.259 for (1). Even after plastic deformation by upsetting (5) continued to have good oxidation resistance in the range 800–1050°. Wear resistance was measured by using the disk specimens running against an untreated, normalized shoe of the same steel for a load of 28 kg. and a time of 2 hrs. The specimen calcined for 5 hrs. at 850° but not further heat-treated gave the lowest total wt. loss, and was slightly better than a chromized specimen.

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Hot and Cold Ductility of Aluminium Coatings. S. O. Bogdanov. (Vestnik Mashinostroeniya, 1952, 32, 48-54). Experiments on calorized specimens are described.

ACCESSION NR: AP4028999 S/0126/64/017/003/0408/0412

AUTHOR: Bogdanov, S. G.

TITLE: Resistance to grain-size increase in steel undergoing deformation at 850 and 900C

SOURCE: Fizika metallov i metallovedeniye, v. 17, no. 3, 1964, 408-412

TOPIC TAGS: steel, steel grain, growth resistance, hot worked steel, steel recrystallization, grain surface energy, dislocation, horophylic atom, steel 40, steel 40Kh, microstructure

ABSTRACT: Experiments were performed to substantiate the theory explaining resistance to growth in grains of steel being deformed and undergoing recrystallization at high temperatures. The theory explains this resistance by the concentration in the boundary layers of dislocations and admixture atoms (including "horophylic"). The concept of "horophylic" admixtures was introduced by Gibbs, who showed that surface layers of liquid solutions contain concentrated admixtures which lower the surface energy. V. I. Arkharov (Trudy IFM AN SSSR, Sverdlovsk, no. 8, 1946) also noted that the solubility of the horophylic admix-

Card 1/3

ACCESSION NR: AP4028999

tures in the surface layers depends on the temperature and that at lowered temperatures the diffusion of the admixtures out of the surface layers is inhibited by persistent flaws in the crystalline lattices. These flaws originate during hot working of a material and are retained even after slow cooling or at high temperatures. The presence of such flaws prevents the equalization of the admixtures throughout the body of a grain. Steels 40 and 40Kh were used in the present experiments. The influence of deformation on the grain size in samples forged at 1100C and then quenched in water was first determined. These samples, cut into sections and polished, showed a uniform microstructure in the deformed zones (grain size of 4-5 units) and in the undeformed zones (2-3 units). It was next proved by forging the samples down from 20 to 12 mm at 1000, 1100, and 1200C that temperatures in this range had little influence on the grain size. To determine their resistance to grain growth, other samples were forged down from 20 to 12 mm at 1200C and were divided into two groups. One group was placed in the furnace (heated to 850C) immediately after forging, the other after first being cooled in air. Samples from both groups were quenched in water after 30, 60, 120, 150, 180, 300, and 600 minutes. Figure 1 of the Enclosure shows the change in the grain size after various periods of heating. Here Curve 1 pertains to the grain size of samples heated directly after forging; Curve 2 -- to the cycle of forging-air cooling-heating. The same results were obtained after heating

Card 2/4 3

ACCESSION NR: AP4028999

at 900C and proved to be true for both types of steel. These experiments show that grains diminished by deformation at 1100-1200C become immune to growth at 850-900C and that their collective recrystallization is arrested in this range. These phenomena may be explained by the concentration of horophylic admixtures in the surface layers and by the subsequent diminution of the surface energy in grains. Slow cooling followed by heating destroys this immunity and fosters renewed grain growth. Orig. art. has: 5 figures.

ASSOCIATION: Moskovskiy avtomekhanicheskiy institut (Moscow Automechanical Institute)

SUBMITTED: 20Mar63 DATE ACQ: 27Apr64 ENCL: 01

SUB CODE: PH, ML NO REF SOV: 007 OTHER: 001

Card 3/4

BOGDANOV, Sergey Il'ich; CHARUYSKIY, A.P., redaktor; KOGAN, F.L., tekhnicheskiy redaktor

[Erecting metal bridges] Montazh metallicheskikh mostov. Moskva, Nauchno-tekhn. izd-vo avtotransportnoi lit-ry, 1955. 347 p. (Bridges, Iron and steel) (MLRA 8:8)

BOGDANOV, S.I.

BOGDANOV, S.I.; ZAMOSTINA, M.A.

Automatic telegram processing. Vest.sviazi 17 no.10:39-40 O '57.
(MIRA 10:11)

1. Nachal'nik Upravleniya elektrosvyazi Ministerstva svyazi BSSR (for Bogdanov). 2. Starshiy inzhener Upravleniya elektrosvyazi Ministerstva svyazi BSSR (for Zamostina).
(Telegraph--Automatic systems)

KRUPENNIKOV, S.S., dotsent; SPERANSKIY, B.A., dotsent; BOGDANOV, S.I., nauchnyy red.; LYTKINA, L.S., red.izd-va; RUDAKOVA, E.I., tekhn.red.

[Assembling precast reinforced concrete construction elements in the Urals] Iz opyta montazha sbornykh zhelezobetonnykh konstruktsii na Urale. Moskva, Gos.izd-vo lit-ry po stroit., arkhit. i stroit. materialam, 1959. 51 p. (MIRA 13:3)
(Ural Mountain region--Precast concrete construction)
(Cranes, derricks, etc.)

15048

BOGDANOV, S. M.

USSR/Transportation of Timber 4308.0300 Aug 1947

"Devices for Loading Lumber on Automobiles," S. M. Bogdanov, 1½ pp

"Les Prom" No 8

Describes operation of machine constructed by Engineers V. I. Karavaev and I. S. Kheyefyets of the Ust'vymles Trust. Four pictures of the machine being transported, standing next to pile of logs, in operation, and the unit of the machine attached to the motor of the automobile.

LC 15048

BOGDANOV, S.N., inzh.

Open ore stockpiles. Prom. stroi. 37 no.4:35-37 Ap. '59.
(MIRA 12:6)

(Ores--Storage)

BOGDANOV, S.N., inzh.

Investigating the heat exchange during the boiling of Freon 12 inside a horizontal pipe. Khol.tekh. 40 no.5:31-35 S-O '63. (MIRA 16:11)

1. Leningradskiy tekhnologicheskiy institut kholodil'noy promyshlennosti.

BOGDANOV, S.P.

USSR/Telegraph Lines
Telephone Lines

Dec 1947

"A Lead-in Test Stand for Inter-city Aerial Communication Lines," G. M. Bogorodskiy, S. P. Bogdanov, 2 pp

"Vestnik Svyazi - Elektrosvyaz'" No 12 (93)

The factory of the Ministry of Communications has produced a new lead-in stand for steel and nonferrous metal lines which makes it possible to protect the station from lightning, to change, control and test the lines, and to test the channels for delivery of conversation. Diagrams of the installation are given.

LO

51T103

BOGDANOV, S.T.

The ISB-2 machine for sorting Baltic herrings. Biul. tekh.-ekon. inform. no.4:55 '58. (MIRA 11:6)
(Sorting devices) (Herring)

BOGDANOV, S.T.

The OBF-400 dust-type flask-washing machine. Biul.tekh.-ekon.inform. no.7:52-53 '58. (MIRA 11:9)
(Bottle washing)

BOGDANOV, S.T.

The DKB-1 crushing and sorting machine for processing cocoa beans. Biul.tekh.-ekon.inform. no.9:54-56 '58. (MIRA 11:10)
(Cocoa) (Milling machinery)

BOGDANOV, S.T.

The IRM machine for dressing small fishes for canning. Biul.tekh.-ekon.inform. no.4:44-46 '58. (MIRA 12:7)
(Fishery products--Preservation)

BOGDANOV, S.T.

The IPB machine for making wax-paper bags and putting them into cans. Biul.tekh.-ekon.inform. no.5:60-61 '59. (MIRA 12:8)
(Canning and preserving)

BOGDANOV, S.T.

Papers submitted for the 10th Pacific Science Congress, Honolulu, Hawaii 21 Aug-6 Sep 1961.

AGAPOVA, G. V., BUDANOVA, L. Y., ZATONSKIY, L. K., ZENKEVICH, N. L., IVANOV, A. G., LARINA, N. I., MAROVA, N. A., and UDINTSEV, G. B., All from the Institute of Oceanology, Academy of Sciences USSR - "The bottom relief of the Pacific Ocean and its cartographic representation" (Section VI.A)

ANDRIYASHEV, A. P., Institute of Zoology, Academy of Sciences USSR - "Myctophid fishes of the Antarctic and the problem of their bipolar distribution in the Pacific Ocean" (Section III.C)

ANDRUSHCHENKO, P. F., and SKORNYAKOVA, N. S., Institute of Oceanology - "The manganese concretions of the Pacific Ocean" (Section VII.C.1)

APH----YEV, G. D. (Name blurred, but may be AFANAS'YEV, G. D.), Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry - (Title of paper is blurred; following is approximate title) - "Makhoyevishich's discontinuty [sic] layer and petrographic data" (Section VII.C)

BALAKINA, L. M., Institute of Earth Physics imeni O. Yu. Schmidt - "The character of stresses and ruptures in the earthquake foci of the Pacific seismic zone" (Section VII.C.2)

BARSUKOV, V. V., Institute of Zoology, "On the Pacific origin of the Anarhichadidae family" (Section III.C)

BATALIN, A. M., Yakutsk State University - "On the heat processes in the waters of the Far East (Section VII.B)

BEKLEMISHEV, K. V., Institute of Oceanology - "On the transformation of the plankton of the Pacific drift and in the adjacent waters" (Section III.C)

BELOUSOV, V. V., and RUDICH, Ye. M., Institute of Earth Physics imeni O. Yu. Schmidt - "Genesis and age of the abyssal depression of the sea of Japan" (Section VII.C.2)

BELYAYEV, G. M., Institute of Oceanology - "Accumulations of squid beaks and shark teeth at the ocean floor" (Section III.C)

BEZRUKOV, P. L., Institute of Oceanology - "Recent sedimentation and the geological history of the Okhotsk sea" (Section VII.C.1)

BEZRUKOV, P. L., LISITSYN, A. P., PETELIN, V. P., and SKORNYAKOVA, N. S., Institute of Oceanology - "Recent sediments of the Pacific" (Section VII.C.1)

BIRSHTEYN, Ya. A., and VINOGRADOV, M. Ye., Institute of Oceanology - "Some specific features in the geographical distribution of abyssal pelagic animals (Amphipoda)" (Section III.C)

BOGDANOV, S. T., Institute of Oceanology - "New charts of cotidal lines and the character of tidal phenomena in the Pacific Ocean" (Section VII.B) ✓

BOGOROV, V. G., BEKLEMISHEV, K. V., and VINOGRADOV, M. Ye., Institute of Oceanology - "The distribution of the zooplankton biomass in the Pacific Ocean" (Section III.C)

BORDOVSKIY, O. K., Institute of Geology Exploitation of Combustible Materials - "The diagenetic changes in bottom sediments from the central part of the Pacific"(Section VII.C.1)

BRODSKAYA, N. G., Institute of Geology - "Sedimentation and the regularities in the distribution of mineral resources in the geosynclinal basins of the Tertiary period in the area of Kamchatka and the Sakhalin Island" (Section VII.C)

BRUYEVICH, S. V., and ZAYTSEVA, Ye. D., Institute of Oceanology - "Some chemical features of sediments and ground solutions permeating the latter in the Pacific (materials of the northwestern part)" (Section VII.C.1)

[illegible], V. A., Institute of Oceanology - "A study of equatorial currents in the western Pacific" (Section VII.B)

BURLUTSKAYA, V. M., and SAMOYLENKO, V. S., Institute of Oceanology - "The formation of air masses in the northern part of the Pacific Ocean" (Section VII.A)

BURMISTROVA, V. D., Institute of Oceanology - "The regions of formation and transition courses of anti-cyclons in the northern part of the Pacific Ocean (Section VII.A)

BOGDANOV, S.V.

"Investigation of Dielectric Properties of Barium Titanate and Other Polycrystalline Materials in a Field of Ultra-high Frequencies." Sub 9 Apr 51, Physics Inst imeni P. N. Lebedev, Acad Sci USSR Cand Physico - Math Sci.

Dissertations presented for science and engineering degrees in MOSCOW during 1951.

SO: Sum. No. 480, 9 May 55.

BOGDANOV, S. V.

Skanavi, G. I., Demeshina, A. I., Bogdanov, S. V. The non-linearity of the relaxation dielectric polarization in solid dielectrics. P. 684.

The P. N. Lebedev Inst. of Physics
Academy of Sciences, USSR
June 26, 1950

SO: Journal of Experimental and Theoretic Physics, Vol. 21, No. 6, June 1951

BOGDANOV, S. V., and KOPYLOVSKIY, B. D.

"Methods of Measuring the Lifetime of Nonequilibrium Charge Carriers in Semiconductors," by S. V. Bogdanov and B. D. Kopylovskiy, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, Pribory i Tekhnika Eksperimenta, No 1, Jul-Aug 56, pp 66-70

The article discusses several methods of measuring the lifetime of nonequilibrium charge carriers in semiconductors which were applied to the investigation of germanium at the Electrophysics Laboratory of the Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR.

Methods for measuring the lifetime of charge carriers with the aid of injected excess carriers are divided into two groups: the photomethod, where the excess carriers are injected with the aid of light, and the pulse method, where the excess carriers are injected by means of an electric field. Each method has its own advantages depending on the conditions set up in the experiment.

The authors thank A. V. Rzhanov and V. S. Vavilov for their assistance.

Sum1258

BOGDANOV, S. V.

G-3

USSR/Electricity - Semiconductors

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 31210 (sic)

Author : Bogdanov, S.V.
Inst :
Title : Progress on Research in Ferroelectricity (All-Union Conference in Leningrad).

Orig Pub : Vestn. AN SSSR, 1956, No 10, 103-106

Abstract : A brief content is given of the following lectures, heard at the conference (19 --23 June 1956): N.S. Novosil'tsev et al., Procedure for Growing Various Titanates and the Properties of These Single Crystals. Yu.S. Puzyrev and I.S. Zheludev, Procedure for Growing Single Crystals of Barium Titanate, the Temperature Dependence of Their Domain Structure, and their Dielectric Hysteresis. K.M. Naumova et al., Growing of Monocrystals of $BaTiO_3$ in Large Volumes and by the Remeyka Method. V.P. Konstantinova and V.A. Yurin, Growing and Dielectric Properties of

C

Card 1/3

BOGDANOV, S.V.

USSR/Electricity - Semiconductors G-3

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 7022

Author : Bogdanov, S.V.
Title : Stationary Distribution of Excess Current Carriers in Germanium that is Partially Illuminated.

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 5, 917-926

Abstract : The stationary distribution of excess carriers in germanium that is partially illuminated by photoactive light is investigated. The one-dimensional problem is considered at low level of injection and in the absence of an external field; surface recombination is neglected. The limitations on the specific resistivity of the excess carriers in the illuminated and the non-illuminated portions of the specimen is determined, the internal field is calculated, as is the magnitude of the occurring space charge for the usual mobility ratio $b = \mu_e/\mu_h > 1$. It is shown that the L (the diffusion length) can be measured not only in the non-illuminated, but also in the illuminated portion of the specimen, provided the width w of the illuminated portion is sufficiently large ($w > 6L$).

Card : 1/1

Bogdanov, S.V.

Category : USSR/Electricity - Dielectrics G-2

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4147

Author : Bogdanov, S.V., Vul, B.M., Razbash, R.Ya.
Title : Influence of Polarization Conditions on the Piezo Properties of Barium Titanate

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 5, 958-962

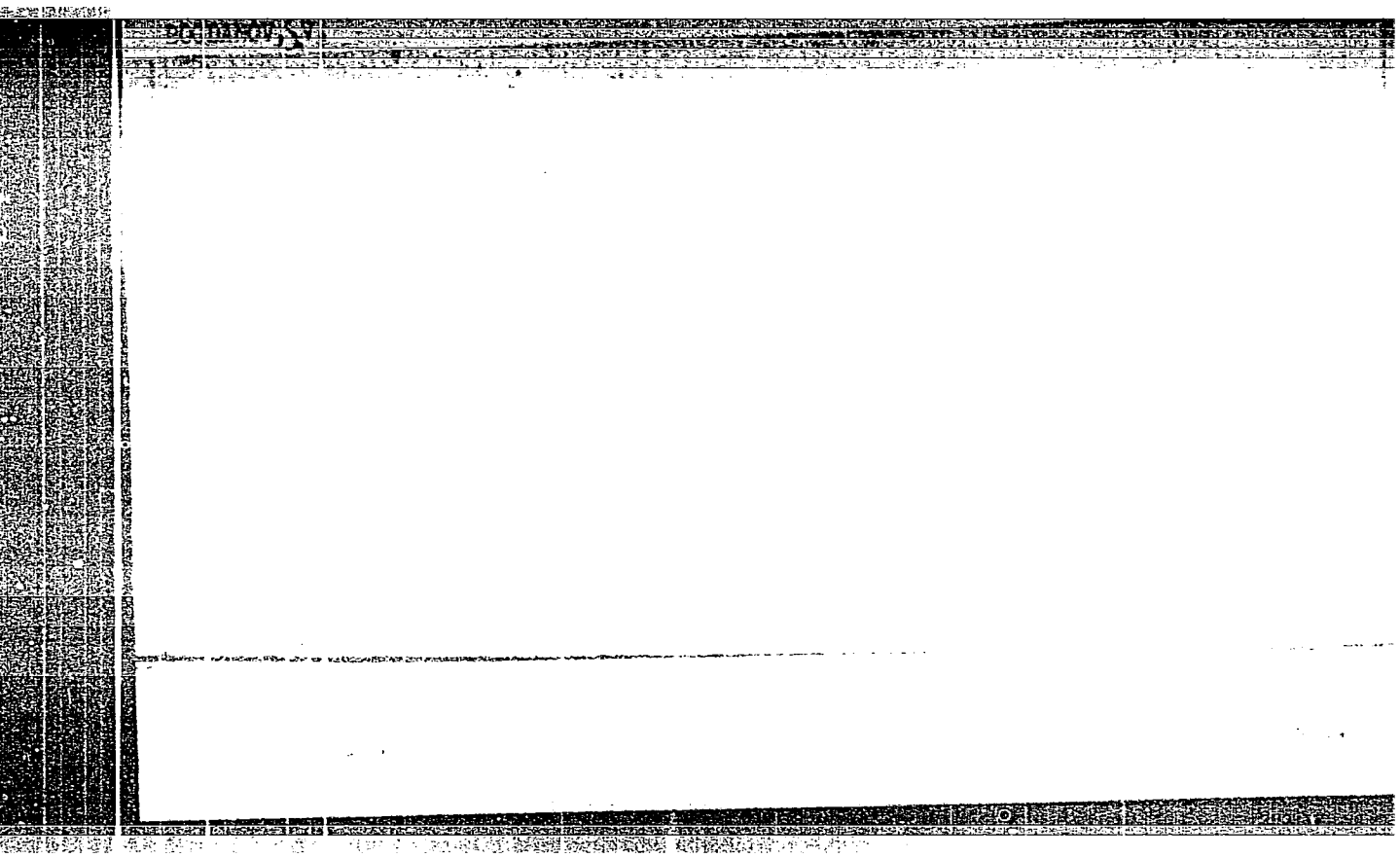
Abstract : The effect of the intensity of the polarizing electric field E and of the temperature T on the piezo-modulus d_{33} of ceramic $BaTiO_3$ was investigated. It is shown, that the polarization of thick specimens can be produced at lower values of E and at higher values of T. The closer the polarization temperature is to the Curie temperature, the less the value of E required for the polarization.

To orient the fundamental part of the domains in the interval of the rapid growth of the spontaneous polarization (6 -- 7° below the Curie point), E must not be less than 5 kv/cm for any values of T of the polarization.

Card : 1/1

The stationary distribution of the surplus charge carriers in germanium on partial irradiation thereof. [illegible] *Zhur. Tekh. Fiz.* 1, 903-11(1957)(Russian translation).—See *C.A.* 56, 10[illegible].

MIT



BOGDANOV, S.N.; VUL, B.M.; RAZBASH, R.Ye.

Piezoelectric modulus of dislocation for polarized barium titanate.
Kristallografiia 2 no.1:115-118 '57. (MLRA 10:7)

1. Fizicheskiy institut imeni P.N. Lebedeva.
(Barium titanates--Electric properties)

120-3-26/40

AUTHOR: Bogdanov, S.V.

TITLE: A Q-Meter Method for Capacity and Loss Measurement at High Frequencies (Metodika izmereniya kumetrom yemkosti i poter' na vysokikh chastotakh)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1957, Nr 3, pp.90-93 (USSR)

ABSTRACT: Measurement of capacity and loss angle at frequencies higher than 10 Mc/s is difficult due to the effects of inductance and resistance of the connecting leads. The method described enables corrections to be introduced into the measured values, thus extending the practical frequency limits. Neglecting the distributed capacity of the leads, and considering only their inductance and resistance, the equivalent circuit can be presented as in Fig.1. Its total impedance is:

$$Z = (R_L + R_x) + j\omega L + 1/j\omega C_x = (R_L + R_x) + (1 - \omega^2 LC_x/j\omega C_x). \quad (1)$$

Card 1/8

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

If $\omega^2 LC_x < 1$, then Z is capacitive and will possess an equivalent capacity $C_э$ together with an equivalent resistance $R_э$, i.e. :

$$Z = R_э + 1/j\omega C_э \quad . \tag{2}$$

Comparing Eq.(1) and Eq.(2) :

$$R_э = R_x + R_L \tag{3}$$

$$C_э = C_x/(1 - \omega^2 LC_x) \quad . \tag{4}$$

The true capacity of the sample C_x and the dielectric loss angle tangent $tg\delta_x$ are found from the measured values $C_э$ and $tg\delta_э = \omega R_э C_э$, if the lead inductance L and the resistance R_L are known, by the equations:

$$C_x = C_э/(1 + \omega^2 LC_э) \quad , \tag{5}$$

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

$$\operatorname{tg}\delta_x = \frac{\operatorname{tg}\delta_0 - \omega R_L C_0}{1 + \omega^2 L C_0} \qquad (6)$$

assuming that $\operatorname{tg}^2\delta_x \ll 1$ and $\operatorname{tg}^2\delta_0 \ll 1$. R_L and L can be measured on the Q-meter by the following methods:
(A) The leads are short-circuited and the leads replace the coil of the Q-meter. Then:

$$L = 1/\omega^2 C_o \,, \qquad (7)$$

$$R_L = 1/\omega Q_o C_o \,. \qquad (8)$$

If the short-circuited leads are connected in series with the Q-meter coil, then:

$$L = \frac{C_o - C_1}{\omega^2 C_o C_1} \,, \qquad (9)$$

Card 3/3

$$R_L = \frac{C_o Q_o - C_1 Q_1}{\omega C_o C_1 Q_o Q_1} \,. \qquad (10)$$

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

(B) If a known capacity is available, then the lead inductance can be found from:

$$L = \frac{C_э - C_{изт}}{\omega^2 C_э C_{изт}} \qquad (11)$$

where $C_{изт}$ is the known capacity.

(C) If two capacitors of different capacities C_1 and C_2, but made of the same material, are available, then R_L and L can be found from:

$$L = \frac{C_{1э} - \alpha \cdot C_{2э}}{(\alpha - 1)\omega^2 C_{1э} C_{2э}} , \qquad (12)$$

$$R_L = \frac{(1 + \omega^2 L C_{2э}) tg\ \delta_{1э} - (1 + \omega^2 L C_{1э}) tg\ \delta_{2э}}{\omega(C_{1э} - C_{2э})} , \qquad (13)$$

Card 4/8 where $C_{1э}$, $C_{2э}$ are the equivalent capacities and

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

$tg\ \delta_{1\vartheta}$, $tg\ \delta_{2\vartheta}$ are the loss factors, corresponding to C_1 and C_2 . $\alpha = C_1/C_2$. This assumes that ϑ and $tg\ \delta$ are the same for both capacitors. The above relationships were checked experimentally. The results are tabulated in Table 1. The values for R_L and L are tabulated in Table 2. The effect of L on the accuracy of measurement is tabulated in Table 3 which shows that the maximum error for C_x does not exceed 5%. These results are only true, providing that the lead lengths are considerably less than 1/4 of the wavelength. For frequencies 30-50 Mc/s, the lead lengths are comparable to $1/4\lambda$, and the leads must be considered as lines with distributed constants. Therefore it is most convenient to use coaxial cables of known length and possessing a known characteristic impedance. The input impedance of such a system is given by:

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

$$Z_{вх} = Z_0 \frac{Z_0 \operatorname{sh} \gamma l + Z_н \operatorname{ch} \gamma l}{Z_0 \operatorname{ch} \gamma l + Z_н \operatorname{sh} \gamma l}, \qquad (14)$$

where Z_0 is the characteristic impedance; $Z_н$ - the load impedance; $\gamma = \alpha + j\beta$ - the transmission constant; α - the attenuation constant; $\beta = 2\pi/\lambda$ - the phase constant; λ - the wavelength; l - the length of the lead. Measuring $Z_{вх}$ and knowing Z_0, γ and l, then $Z_н$ can be found from Eq.(14). The calculation can be simplified if the open-circuit impedance formula is used:

$$Z_{вх} = \frac{Z_0^2 + Z_{хх} Z_н}{Z_{хх} + Z_н} \qquad (15)$$

where $Z_{хх}$, the open-circuit impedance, is measured directly on the Q-meter. If $Z_{хх}$ and $Z_{вх}$ are capacitive

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

(which occurs when $l = n\lambda/2 + l'$, where $n = 0; 1; 2;...$ and $l' \ll \lambda/4$, (xx = open circuit, ex = input) and $tg\,\delta_{xx} \ll 1$ and $tg\,\delta_{ex} \ll 1$, then results obtained from (15) do not differ significantly from results from (5) and (6). To avoid increase of C_3 at high frequencies (thus limiting the range of the apparatus), the cable length is made $l \approx \lambda/2$ when Z_{xx} is resistive and considering $Z_{xx} \gg Z_o$ and $Z_{xx} \gg R_{ex}$, Eq.(15) can be re-arranged as follows:

$$C_x = C_{ex}\left\{1 + \left[\frac{C_o(Q_o - Q_1)}{C_{ex}Q_oQ_1}\right]^2\right\}, \approx C_1 - C_2 , \qquad (16)$$

Card 7/8

A Q-Meter Method for Capacity and Loss Measurement at High Frequencies.

$$tg\,\delta_x = \frac{C_1(Q_1 - Q_2)}{C_{вх} Q_1 Q_2} \left[- \omega^2 C_0^2 R_{вх}^2 \frac{Q_x(Q_0 - Q_1)}{Q_0(Q_1 - Q_2)} \right] , \quad (17)$$

where C_0 , Q_0 are the capacity and Q-factor of the Q-meter without the cable; $C_1 = C_0$, Q_1 - the capacity and Q-factor of the circuit with open-circuit cable; C_2 , Q_2 - the capacity and Q-factor with the load connected. To avoid errors due to the capacity of the holder, the holder is made of a line section having the same characteristic impedance as the lead cable. There are 3 tables, 1 figure and no references.

ASSOCIATION: Physics Institute im. P.N.Lebedev, AS, USSR (Fizicheskiy institut im. P.N.Lebedeva AN SSSR)

SUBMITTED: November 16, 1955.

AVAILABLE: Library of Congress.

Card 3/3 1. Frequency-Measurement 2. Capacitance-Measurement 3. Mathematics-Theory

Bogdanov, S.V.

SUBJECT: USSR/Luminescence 48-3-11/26

AUTHORS: Bogdanov S.V., Vul B.M. and Timonin A.M.

TITLE: On the Connection between Dielectric, Piezoelectric and Elastic Properties of Polycrystallic Ceramics and Those of Monocrystals (O svyazi mezhdu dielektricheskimi, p'yezoelektricheskimi i uprugimi svoystvami polikristalicheskoy keramiki i monokristalla)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya fizicheskaya, 1957, Vol 21, #3, pp 374-378 (USSR)

ABSTRACT: A general method for calculating the tensor of dielectric permittivities, the tensor of piezomoduli and the tensor of elastic constants of a polycrystallic material by these characteristics of monocrystals is proposed. This method is based on the averaging of equations of the piezoelectric converter and represents a generalization of the studies by Vul, Shirobokov and Adirovich (1). The equations obtained make it also possible to correlate the properties of polarized and non-polarized ceramics.

By definition, a polycrystallic sample consists of monocrystals oriented at random. If this sample is subjected to the action

Card 1/2

TITLE: On the Connection between Dielectric,Piezoelectric and Elastic Properties of Polycrystallic Ceramics and Those of Monocrystals (O svyazi mezhdu dielektricheskimi, p'yezoelektricheskimi i uprugimi svoystvami polikristalicheskoy keramiki i monokristalla)

of a constant electric field of sufficient intensity to "polarize" it, this action will give rise to some orientation in distribution of the polar axes of microcrystals. After such a treatment, the polar axes of individual microcrystals will be confined within a certain solid angle, whose magnitude is determined by the polarization mechanism.
The equations obtained enable one to calculate the piezomoduli of a monocrystal by the known piezomoduli of a ceramic material. Using the values of piezomoduli for barium titanate ceramics, the authors calculate the piezomoduli of the monocrystal which agree well with the data given in the literature.
The bibliography lists 2 references, of which 1 is Slavic (Russian).

INSTITUTION: Physical Institute im.Lebedev of the USSR Academy of Sciences.
PRESENTED BY:
SUBMITTED: No date indicated.
AVAILABLE: At the Library of Congress.
Card 2/2

Bogdanov, S.V.

SUBJECT: USSR/Luminescence 48-3-14/26

AUTHOR: Bogdanov S.V.

TITLE: Piezoproperties of Ferroelectric Ceramics Consisting of Barium Titanate with Some Additions (P'yezosvoystva segnetokeramiki iz titanata bariya s nekotorymi dobavkami)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya fizicheskaya, 1957, Vol 21, #3, pp 390-393 (USSR)

ABSTRACT: An investigation of the dependence of piezocharge on mechanical strain in a number of solid solutions containing $BaSnO_3$ and in barium titanate with additions of SnO_2 has shown that effects of the domain structure changes play a decisive role.

The paper deals with some dielectric and piezoelectric properties of barium titanate containing 3 % of SnO_2, which was named "T-3".

The inclusion of SnO_2 into barium titanate leads to the lowering of its Curie point, increase of dielectric permittivity; decrease of spontaneous polarization, residual polarization and coercive force, and to the increase of the elasticity

Card 1/3

TITLE: Piezoproperties of Ferroelectric Ceramics Consisting of Barium Titanate with Some Additions (P'yezosvoystva segnetokeramiki iz titanata bariya s nekotorymi dobavkami)

modulus and Poisson coefficient.

The T-3 compound is characterized by the following data:

a. Its dielectric permittivity at the room temperature, measured in a weak field of the order of 2.5 v/cm and at a frequency of 190 ko/s, is equal to $(1.7 \text{ to } 1.8).10^3$;

b. The Curie point is at 82 to 87°C;

c. In the region of temperatures from 30 to 35°C, some increase of dielectric permittivity, connected apparently with a low-temperature phase transition, is observed.

The author draws the following conclusions from his investigations:

a. That barium titanate with some additions, such as SnO_2, or solid solutions containing barium stannate have a lower Curie point in comparison with $BaTiO_3$, a decreased spontaneous polarization and coercive force, and an increased elasticity

TITLE: Piezoproperties of Ferroelectric Ceramics Consisting of Barium Titanate with Some Additions (P'yezosvoystva segneto-keramiki iz titanata bariya s nekotorymi dobavkami)

modulus and Poisson coefficient, which makes the re-orientation of domains by mechanical strains easier;

b. That reversible changes in domain structure under effect of mechanical strains lead to a considerable rise of piezomodulus d_{33};

c. That it can be presumed that changes in the domain structure will not occur at sufficiently high frequencies, and that effects connected with them will not manifest themselves.

The article contains 5 figures. The bibliography lists 1 Russian reference.

INSTITUTION: Physical Institute im. Lebedev of the USSR Academy of Sciences

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

Card 3/3

Bogdanov, S.V.

SUBJECT: USSR/Luminescence

48-3-16/26

AUTHORS: Bogdanov S.V. and Timonin A.M.

TITLE: On the Methods of Measuring Piezomodulus by means of Radial Oscillations of a Disk (K metodike izmereniya p'yezomodulya iz radial'nykh kolebaniy diska)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya fizicheskaya, 1957, Vol 21, #3, pp 397-398 (USSR)

ABSTRACT: Determination of piezomodulus d_{31} from radial oscillations of a disk by the resonance and anti-resonance methods is based on the fact that some quantities determined experimentally, such as dimensions and density of a sample, the frequency of resonance and anti-resonance, and dielectric permittivity, can be connected with piezoelectric and elastic constants, if the value of the Poisson coefficient is known. As the latter is usually not known, its average value for the given material is used for computations; but this method is not very accurate.

Therefore, the author suggests to apply the following method: to measure the second resonance frequency of disk radial

Card 1/2

TITLE: On the Methods of Measuring Piezomodulus by means of Radial Oscillations of a Disk (K metodike izmereniya p'yezomodulya iz radial'nykh kolebaniy diska)

oscillations and then to find graphically the Poisson coefficient making use of some existing relations.

Thus by making just one additional measurement, that of second resonance frequency, it is possible to determine the Poisson coefficient and then the piezomodulus d_{31}.

The bibliography lists one reference in Russian, which was translated from English.

INSTITUTION: Physical Institute im. Lebedev of the USSR Academy of Sciences

PRESENTED BY:

SUBMITTED: No date indicated

AVAILABLE: At the Library of Congress.

Card 2/2

24(3)

AUTHORS: Cherepanov, A. M., Bogdanov, S. V., Razbash, R. Ya.

SOV/48-22-12-22/33

TITLE: Piezoceramics With High Curie Temperature (Segnetokeramika s vysokoy temperaturoy Kyuri)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958, Vol. 22, Nr 12, pp 1497-1499 (USSR)

ABSTRACT: In the present paper a new method for the preparation of solid solutions with $PbTiO_3$-content is described. Experimental results have shown that it is possible to obtain samples of solid solution with a $PbTiO_3$-content not exceeding 15 mole %, by annealing in free atmosphere. In order to obtain samples having such a composition, no less than 20 mole % $PbTiO_3$ must be introduced into the initial composition. The method employed by the authors is to introduce the samples into casings of fireproof clay both in the temporary and in the final annealing process and to place these casings upon an alumina layer (Al_2O_3) which should be at least 5 mm thick. The samples are thereupon

buried in alumina. The layer thickness above the samples must be of about 8-10 mm, on a sample surface of up to ~10 cm^2. On a larger surface this layer must be correspondingly thicker. The annealing heat is experimentally determined for each composition. It depends on a number of factors: relations of initial components to one another, purity, fineness of grinding, etc. In the case of pure initial components a temperature of 1350° ($PbTiO_3$) up to 1450°($BaTiO_3$) has been determined for the final annealing of the $BaTiO_3$-$PbTiO_3$-samples. A schematic illustration is given in figures 1a and b of the placing of the lead containing samples for the temporary and the final annealing process. The method described has already been successfully employed for the past 5 years for the preparation of the various lead containing compositions. The authors thank B. M. Vul for having given valuable advice. There are 5

Piezoceramics With High Curie Temperature SOV/48-22-12-22/33

figures, 1 table, and 8 references, 4 of which are Soviet.

ASSOCIATION: Fizicheskiy institut imeni P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev, Academy of Sciences, USSR)

Card 3/3

24(3)

AUTHORS: ~~Bogdanov, S. V.~~, Kovalenko, G. M., Razbash, R. Ya., Cherepanov, A. I. SOV/48-22-12-23/33

TITLE: On Dielectric Properties of Solid Solutions of the Triple System $BaTiO_3$ - $PbTiO_3$ - $BaSnO_3$ (Dielektricheskiye svoystva tverdykh rastvorov troynoy sistemy $BaTiO_3$-$PbTiO_3$-$BaSnO_3$)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958, Vol 22, Nr 12, pp 1500 - 1503 (USSR)

ABSTRACT: In the present paper some of the dielectric properties of samples were investigated, the $BaSnO_3$ content of which was higher by 2%, 5.5%, 10% and 15% than the sum assumed as 100% ($BaTiO_3$+$PbTiO_3$). The samples were produced from the initial components $BaCO_3$, $PbCO_3$, TiO_2 and SnO_2. The investigations showed that the effect of dielectric properties is additive in the first approximation at a lower content of $PbTiO_3$ and $BaSnO_3$ in solid solutions. This additivity, is, however,

Card 1/3 disturbed in the case of a considerable content of $PbTiO_3$

(20 ÷ 25%). This deviation can be due to two causes: first, a certain volatilization of lead is possible with a higher content of $PbCO_3$ in the initial solution; secondly, it is possible that an other lead compound except $PbTiO_3$ forms during the synthesis process, corresponding to the composition "$PbSnO_3$" described in references 13-15. Its influence upon dielectric properties of solid solutions is to a certain degree equivalent to the effect of $BaSnO_3$ (Ref 6). In the initial layer the quantity of the forming $PbSnO_3$ can be assumed to be proportional to $PbCO_3$ and SnO_2. The increase of the proportion of $BaSnO_3$ in solid solutions causes a decrease of the spontaneous polarization of the domains themselves on the one hand; on the other hand, when the voluminal electrostriction of the domains is diminished their orientation is facilitated by the electric field. The second effect is probably decisive with corresponding compositions. In the compositions

95 $BaTiO_3$ + 5$PbTiO_3$ + 2.5$BaSnO_3$

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On Dielectric Properties of Solid Solutions of the Triple System $BaTiO_3$-$PbTiO_3$-$BaSnO_3$ SOV/48-22-12-23/33

$95BaTiO_3 + 5PbTiO_3 + 5BaSnO_3$
$90BaTiO_3 + 10PbTiO_3 + 5BaSnO_3$
a certain increase of the spontaneous and the residual polarization (as compared with pure $BaTiO_3$) can be observed when the coercive force remains nearly unchanged. These compositions also show a well formed hysteresis loop of a satisfactory rectangular form at a relatively low tension of the external field. There are 5 figures, 1 table, and 15 references, 11 of which are Soviet.

ASSOCIATION: Fizicheskiy institut imeni P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR)

Card 3/3

24(3)

AUTHORS: Kovalenko, G. M., Bogdanov, S. V., Cherepanov, A. M.

SOV/48-22-12-25/33

TITLE: On the Effect of Admixtures of Fe_2O_3, SrO, SnO_2, ZrO_2, and $BaSnO_3$ on the Characteristics of Dielectric Hysteresis Loops of Polycrystalline $BaTiO_3$ and of Solid Solutions $BaTiO_3$-$PbTiO_3$ (Vliyaniye primesey Fe_2O_3, SrO, SnO_2, ZrO_2 i $BaSnO_3$ na kharakteristiki petli dielektricheskogo gisterezisa polikristallicheskogo $BaTiO_3$ i tverdykh rastvorov $BaTiO_3$-$PbTiO_3$)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958, Vol 22, Nr 12, pp 1508 - 1511 (USSR)

ABSTRACT: The present paper tries to clarify the effect of some admixtures on the characteristics of dielectric hysteresis loops of pure polycrystalline $BaTiO_3$ as well as of some solid $BaTiO_3$-$PbTiO_3$-solutions. Barium titanate and six of its solid solutions with a lead content up to 30% mol were used as initial materials. Fe_2O_3, SrO, SnO_2 and ZrO_2 up to 3% by

Card 1/3

On the Effect of Admixtures of Fe_2O_3, SrO, SnO_2, ZrO_2, SOV/48-22-12-25/33
and $BaSnO_3$ on the Characteristics of Dielectric Hysteresis Loops of Polycrystalline $BaTiO_3$ and of Solid Solutions $BaTiO_3$-$PbTiO_3$

weight above the initial composition were added as admixtures. Data concerning investigated compositions are recorded in table 1. The method used for the production of samples was the same as that for the extraction of barium titanate. The annealing of lead-containing composition was carried out under conditions which prevented the volatilization of lead oxide. The sintering temperature reached 1550° with some compositions. It was shown that small quantities of Fe_2O_3, SrO, SnO_2, ZrO_2 and $BaSnO_3$ are already sufficient to exert an influence on the basic characteristics of dielectric hysteresis loops of $BaTiO_3$ as well as of solid $BaTiO_3$+$PbTiO_3$ solutions. The tension of the coercitive field and the tension of the electric field required for saturation are considerably reduced by admixtures in individual cases. The sufficiently high values of spontaneous and residual polarization as well as the rectangular loops of the initial material do not change. There are 3 tables and 7 references.

Card 2/3

On the Effect of Admixtures of Fe_2O_3, SrO, SnO_2, ZrO_2, SOV/48-22-12-25/33
and $BaSnO_3$ on the Characteristics of Dielectric Hysteresis Loops of Polycrystalline $BaTiO_3$ and of Solid Solutions $BaTiO_3$-$PbTiO_3$

ASSOCIATION: Fizicheskiy institut imeni P. N. Lebedeva Akademii nauk SSSR
(Physics Institute imeni P. N. Lebedev, Academy of Sciences, USSR

Card 3/3

BOGDANOV, S.V.

PHASE I BOOK EXPLOITATION SOV/4379

Vsesoyuznaya konferentsiya po fizike dielektrikov. 2d, 1958

Fizika dielektrikov; trudy vtoroy vsesoyuznoy konferentsii (Physics of Dielectrics; Transactions of the 2d All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1960. 532 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskiy institut imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokadomskaya; Tech. Ed.: I.N. Dorokhina; Editorial Board: (Resp. Ed.) G.I. Skanavi, Doctor of Physics and Mathematics (Deceased), and K.V. Filippova, Candidate of Physics and Mathematics.

PURPOSE: This collection of reports is intended for scientists investigating the physics of dielectrics.

COVERAGE: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskiy institut imeni P.N. Lebedeva (Physics Institute imeni P.N. Lebedev) in November 1958 was attended by representatives of the principal scientific centers of the USSR and of several other countries. This collection contains most of the reports presented at the conference and summaries of the discussions which followed. The reports in this collection deal with dielectric properties, losses, and polarization, and with specific inductive capacitance of various crystals, chemical compounds, and ceramics. Photoelectrets, ferroelectric crystals, and various radiation and irradiation effects on dielectrics are investigated. The volume contains a list of other papers presented at the conference dealing with polarization, losses, and breakdowns of dielectrics, which were published in the journal Izvestiya AN SSSR, seriya fizicheskaya, Nos. 1 and 2, 1960. No personalities are mentioned. References accompany each report.

Bogdanov, S. V.

81960
S/181/60/002/04/20/034
B002/B063

24.7300

AUTHORS: Bogdanov, S. V., Razbash, R. Ya.

TITLE: The Character of High-temperature Phase Transition in Some Solid Solutions of $BaTiO_3$ - $BaSnO_3$

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 4, pp 670-672

TEXT: Barium titanate with a low content of barium stannate is ferroelectric. Its Curie point is found near 100°C and below this temperature, depending on its content of barium stannate. It was the purpose of the present paper to determine the type of phase transition occurring in this process (first or second type). Four specimens of barium titanate with a barium-stannate content of 5, 7.5, 10, and 15% were prepared by a group of technologists under the direction of A. M. Cherepanov. Curie point and dielectric constant ε were measured, constant electric fields of a high strength being applied at the same time. (Table). Fig. 1 shows the temperature dependence of ε of a specimen at different field strengths. Fig. 2 indicates that the Curie point is shifted up to 20°C by the application

Card 1/2

81960

The Character of High-temperature Phase Transition in Some Solid Solutions of $BaTiO_3$ - $BaSnO_3$

S/181/60/002/04/20/034
B002/B063

of a field strength of 15 kv/cm. This shift is proportional to the field strength. Thus, a phase transition of the first type took place. This assumption is supported by the occurrence of a temperature hysteresis of ε. Mention is made of publications by Roy, Kholodenko, and Sinyakov. There are 2 figures, 1 table, and 7 references: 6 Soviet and 1 Swiss.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR, Moskva (Institute of Physics imeni P. N. Lebedev of the AS USSR, Moscow)

SUBMITTED: May 19, 1959

Card 2/2

9.2180

85006

S/048/60/024/010/015/033
B013/B063

AUTHORS: Bogdanov, S. V., Kovalenko, G. M., and Cherepanov, A. M.

TITLE: Some Physical Properties of Piezoelectric Monocrystals of Solid $BaTiO_3$-$PbTiO_3$, $BaTiO_3$-$BaSnO_3$, $BaTiO_3$-$PbTiO_3$-$BaSnO_3$ Solutions

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 10, pp. 1234-1237

TEXT: Monocrystals of the systems mentioned in the title were obtained with a $PbTiO_3$ content of up to 15% and a $BaSnO_3$ content of up to 10% from the solution in molten KF by way of slowly cooling the solution from 1000 ÷ 1200° to ~400°C. The same method was applied for obtaining monocrystals from the initial composition 85% $BaTiO_3$-10%$PbTiO_3$-5%$BaSnO_3$. The crystals were bred from previously synthesized $BaTiO_3$, $PbTiO_3$, $BaSnO_3$, and their individual components. Plane-parallel plates without cracks nor inclusions were employed in the process. Fig. 1 shows the dependence of

Card 1/3

Some Physical Properties of Piezoelectric Monocrystals of Solid $BaTiO_3$-$PbTiO_3$, $BaTiO_3$-$BaSnO_3$-, $BaTiO_3$-$PbTiO_3$-$BaSnO_3$ Solutions

the dielectric constant ε of $BaTiO_3$ monocrystals on the field strength of an alternating field. Fig. 2 shows the dependences of ε on the field strength of the alternating field for single crystals of different compositions. As may be seen, the dielectric constant rises with an increase of the $BaSnO_3$ content, compared to the ε of the $BaTiO_3$. The increase of the $PbTiO_3$ content, however, is followed by a drop of the dielectric constant. For all the crystals, the authors studied the temperature dependence of ε at different values of the alternating field. Since it was the same for all of the monocrystals investigated, it is shown in Fig. 3, restrictedly to the composition (95%$BaTiO_3$-5%$PbTiO_3$) only. This shows a strong differentiation of the dependence of ε for large fields and of $\varepsilon = f(T)$ for small fields. Dielectric hysteresis loops were taken for all specimens. The measurement results are tabulated. The characteristics of the single crystals were improved in all cases by introducing Fe_2O_3 into the mixture serving for the crystal breeding. The dependences of the quantities examined on the composition of the

85006

Some Physical Properties of Piezoelectric Monocrystals of Solid $BaTiO_3$-$PbTiO_3$, $BaTiO_3$-$BaSnO_3$-, $BaTiO_3$-$PbTiO_3$-$BaSnO_3$ Solutions

S/048/60/024/010/015/033
B013/B063

monocrystals were found to be the same as in polycrystalline specimens of a similar composition. However, the dielectric constant, the spontaneous and the residual polarization are higher in monocrystals whereas the coercive force is smaller than in polycrystalline specimens. The present paper was read at the Third Conference on Piezoelectricity, which took place in Moscow from January 25 to 30, 1960. There are 3 figures, 1 table, and 13 references: 9 Soviet.

Card 3/3

85009

9.4300 (1137, 1138, 1143)

S/048/60/024/010/018/033
B013/B063

AUTHORS: Bogdanov, S. V. and Rassushin, V. A.

TITLE: The Semiconductor Properties of $BaTiO_3$

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 10, pp. 1247-1250

TEXT: The authors studied the effect of some slight additions to $BaTiO_3$ upon its semiconductor properties. Some data are given concerning the dependence of log ρ on 1/T for $BaTiO_3$ monocrystals, to which lanthanum and vanadium were added. The crystals were bred according to the method described by Remeika. On the introduction of additions the number of lamella-shaped crystals was reduced, and the principal mass was granulated. In the case of V_2O_5 the crystals were bright-yellow. With La_2O_3 the color varied between pink and violet. Regarding the addition concentration in monocrystals, no precise values could be established. By indirect values it is possible to estimate whether the addition is contained in the crystal. Fig. 1 shows the temperature dependences of

Card 1/3

The Semiconductor Properties of $BaTiO_3$

S/048/60/024/010/018/033
B013/B063

ε for monocrystals with La and for $BaTiO_3$. The temperature dependence of resistivity was measured for the monocrystals obtained. Individual results are given in Fig. 2 for crystals with vanadium. At room temperature, resistivity amounts to $1.37 \cdot 10^{12}$ ohm·cm. For specimens with lanthanum, data are given in Fig. 3. It may be seen that there is an anomalous section in the curve $\log \rho = f(1/T)$. This resembles the section described by Saburi for ceramic $BaTiO_3$ specimens with rare earths. Its existence can likewise serve as indirect evidence of the presence of the addition in the crystal. A great reduction of the quantity ρ could not be achieved. Similar results were obtained on a large number of specimens. The anomalous course of the curve $\rho(T)$ can be explained by the fact that this section lies in the region of the phase transition, during which a rearrangement of the zonal crystal structure takes place (Ref. 12). Below the phase transition the additions are split, which fact leads to an increase of conductivity. Above the phase transition splitting disappears and conductivity is reduced. Mention is made of M. D. Mashkovich, Ye. V. Sinyakov, B. K. Chernyy, A. F. Yatsenko. The present paper was read at the Third Conference on Piezoelectricity, which took place in Moscow from

85009

The Semiconductor Properties of $BaTiO_3$

S/048/60/024/010/018/033
B013/B063

January 25 to 30, 1960. There are 3 figures and 12 references: 5 Soviet, 3 Japanese, 1 Swiss, and 1 US.

X

85877

S/048/60/024/011/013/036
B006/B056

9.2180 (2303, 3203)
24.7800 (1162, 1144)

AUTHOR: Bogdanov, S. V.

TITLE: The Dielectric Constants of Ceramic $BaTiO_3$ Piezoelements

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 11, pp. 1353 - 1356

TEXT: The present paper is a reproduction of a lecture delivered on the 3rd Conference on Ferroelectricity which took place in Moscow from January 25 to 30, 1960. The fact that ε of polarized $BaTiO_3$ samples (piezoelements) differs from ε of unpolarized ceramics may be explained a) by piezoelectric reaction, and b) by domain orientation in polarization. These two possibilities are theoretically discussed in the introduction, after which a report is given on ε-measurements made on two lots of $BaTiO_3$ ceramics, and the part played by the two effects is estimated. The two lots consisted of 30 samples each; the samples were of cubic shape, their side length was 10.0 mm. The two series were prepared in different ways. The dielectric constant was measured before and after

Card 1/4

polarization, viz. at 50 cps and 11 Mc/sec. These frequencies are partly essentially below and partly essentially above the resonance frequency (250 kc/sec). It is assumed that the ε of the polarized samples measured at 50 cps corresponds to the ε^{σ} value of the theory (ε^{σ} is the dielectric constant of the "free" crystal and greater than ε^{ξ}, the dielectric constant of the "compressed" crystal, σ denotes the mechanical stress, ξ - deformation), and that measured at 11 Mc/sec corresponds to ε^{ξ}. Also the piezomoduli d_{33} and d_{31} were measured on the polarized samples, as also ε 10-15 days after polarization. The following results were obtained:

lot	before polarization		after polarization		
	ε_{k1}(50 cps)	ε_{k2}(11 Mc/sec)	$\varepsilon^{\sigma}_{33}$	ε^{ξ}_{33}	d_{33}(CGSE)
I	1660	1460	1770	1290	$5.4 \cdot 10^{-6}$
II	1510	1330	1640	1200	$5.2 \cdot 10^{-6}$

It is especially pointed out that ε becomes smaller with increasing frequency and that $\varepsilon^{\sigma}_{33} > \varepsilon_{k1}$ and $\varepsilon^{\xi}_{33} < \varepsilon_{k2}$ holds. For purposes of control,

The Dielectric Constants of Ceramic $BaTiO_3$ Piezoelements

S/048/60/024/011/013/036
B006/B056

the electrodes were then removed and new ones fitted (by means of vacuum sputtering), and measurements were again made at 50 cps and 11 Mc/sec, the values being compared with those obtained previously. The following result was now obtained:

	$\varepsilon^{\sigma}_{33}$	ε^{ξ}_{33}	$\varepsilon^{\sigma}_{11}$	ε^{ξ}_{11}
I	1730	1290	1710	1270
II	1620	1210	1560	1170

The results are discussed in detail and the following conclusions were drawn: 1) In unpolarized $BaTiO_3$ ceramics the individual domains of microcrystals cannot be considered to be completely piezoelectrically compressed (at frequencies of up to 10^8 cps). 2) The decrease of the dielectric constant of unpolarized ceramics with increasing frequency is a consequence of dielectric relaxation. There are 3 tables and 3 references: 2 Soviet and 1 US.

Card 3/4

85877

The Dielectric Constants of Ceramic $BaTiO_3$ Piezoelements

S/048/60/024/011/013/036
B006/B056

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

Card 4/4

BOGDANOV, S.V., kand.fiz.-mat.nauk

Miracle crystals. Nauka i zhizn' 27 no.7:11-16 Jl '60.
(MIRA 13:7)

(Ferroelectricity)

GOL'DER, G.A.; TODRES-SELEKTOR, Z.V.; BOGDANOV, S.V.

Structure of benzofuroxan. Zhur.strukt.khim. 2 no.4:478-479 Jl-Ag '61. (MIRA 14:9)

1. Nauchno-issledovatel'skiy fiziko-khimicheskiy institut imeni L.Ya. Karpova i Gosudarstvennyy nauchno-issledovatel'skiy institut organicheskikh poluproduktov i krasiteley imeni K.Ye. Voroshilova.

(Benzofuroxan)

BOGDANOV, S.V.; KOPYLOVSKIY, B.D.

Applying the phase-shift method for measuring the life of nonequilibrium charge carriers in semiconductors. Fiz. tver. tela 3 no. 3:926-934 Mr '61. (MIRA 14:5)

1. Fizicheskiy institut imeni P.N. Lebedeva AN SSSR, Moskva.
(Semiconductors) (Photoelectric measurements)

S/070/61/006/001/001/011
E032/E314

9.2181 (2303, 1144, 1137)

AUTHORS: Bogdanov, S.V., Vul, B.M. and Razbash, R.Ya.

TITLE: Piezoelectric Properties of Polycrystalline Barium Titanate at High Pressures

PERIODICAL: Kristallografiya, 1961, Vol. 6, No. 1, pp. 72 - 77

TEXT: When the external stress applied to a ceramic $BaTiO_3$ specimen is not too high and does not give rise to residual deformations then after the load has been removed, practically all the domains return to their original state. This kind of process is defined as reversible reorientation. If, on the other hand, the external stress is sufficiently high to give rise to residual deformations then after the load has been removed not all the domains will return to the original state and the domain structure will go through a process of readjustment for a period of time after removal of the load. This will continue until the system reaches a state corresponding to a minimum free energy. This process is

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

defined as irreversible reorientation. Both the reversible and irreversible reorientation lead to a reduction in the residual polarisation since the reoriented domains no longer contribute to the residual polarisation of the specimen. This reorientation is equivalent to a certain "additional" compression of the specimen. The present authors have investigated the piezocharge Q_3 as a function of applied stress (σ_{33}). In these experiments a measurement was made of the charge appearing on faces perpendicular to the Z-axis when a mechanical stress is applied at rightangles to these faces. The charge was measured with the aid of a ballistic galvanometer and the stress was applied by means of a special press. Ceramic specimens from various batches of $BaTiO_3$ were investigated. The specimens were cylindrical in form (height 5 mm, diameter 10 mm). It was found that the

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E032/E314

Piezoelectric Properties of ....

magnitude of the piezocharge Q_3 depended not only on σ_{33} but also on the past history of the specimen, e.g. the magnitude and duration of previous loadings and the interval of time between them. The properties of polycrystalline specimens were also found to be strongly dependent on their method of preparation. Fig. 1 shows experimental curves for Q_3 as a function of σ_{33} (Q is plotted along the vertical axis in coulomb/cm^2 and σ_{33} is plotted along the horizontal axis in kg/cm^2. In Fig. 1 the curve designations are as follows:
a - first measurement, specimen loaded; б - first measurement, load removed; в - second measurement; г - third measurement, after artificial ageing. Fig. 2 shows the initial portion of the function $Q_3 = f(\sigma_{33})$. The curve marked a refers to the first measurement and the curve marked б refers to the measurements taken after artificial ageing. These

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

results can easily be explained in terms of the above reversible and irreversible reorientations of the polar axes of domains (Vul and Bogdanov - Ref. 2). The authors have also investigated Q_3 as a function of σ_{11}. Here, the specimens were in the form of cubes (length of edge 6 - 8 mm) and the charge appearing on faces perpendicular to the Z-axis when a mechanical stress was applied. The X-axis was determined with the aid of a ballistic galvanometer. The results obtained are shown in Figs. 3 and 4 (Q_3 in coulomb/cm^2; σ_{11} in kg/cm^2). In Fig. 3, the curve marking is as follows: a - first measurement, load on; б - first measurement, load off; в - second measurement. Fig. 4 shows $Q_3 = f(\sigma_{11})$ for different durations of preliminary loading (a - first measurement; б - second measurement after σ_{11} kept at 2600 kg/cm^2 for 10 min;

Card 4/9

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

6 - the third measurement after σ_{11} at 2 600 kg/cm^2 for 16 hours). The piezoelectric moduli d_{31}, d_{32} and d_{33} were determined and the results obtained are given in the following table:

Piezo-modulus	Before ageing, $\times 10^{-6}$	After ageing, $\times 10^{-6}$	Relative change
d_{33}	4.85	3.37	0.695
d_{32}	1.93	1.49	0.773
d_{31}	1.91	0.89	0.446

Card 5/9

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

In the above table, the ageing was carried out at a load of 2 370 kg/cm^2 for long intervals of time and the moduli were then measured at low loads. These results are also explainable in terms of the reversible and irreversible reorientation. Finally, the $Q_3 = f(\sigma_{11})$ curves were obtained at different temperatures. The result is shown in Fig. 5. Curve a in this figure corresponds to the loading of the specimen for the first time at room temperature, Curve б to the loading for the second time at 60 °C and в to the loading for the third time at 76 °C. After cooling the specimen for 20 hours, the measurements were repeated at 18 °C (Curve г). Finally, the effects of external stresses introduced into the specimen in the process of its preparation are briefly discussed. It is suggested that

Card 6/9

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S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

the experimentally observed difference between d_{31} and d_{32} is probably due to the above internal stresses.

There are 5 figures. 1 table and 8 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P.N. Lebedeva AN SSSR (Physics Institute im. P.N. Lebedev of the AS USSR)

SUBMITTED: April 22, 1960

Card 7/9

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of .....

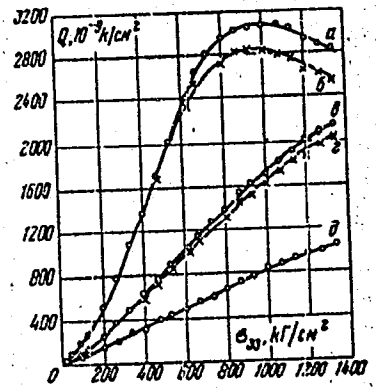


Рис. 1

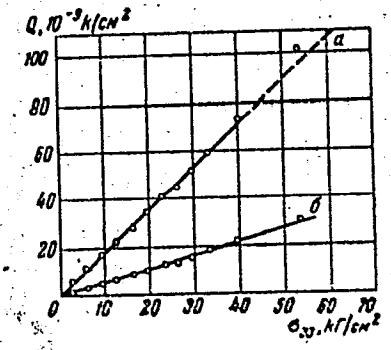


Рис. 2

Card 8/9

S/070/61/006/001/001/011
E032/E314

Piezoelectric Properties of ....

Fig. 3:

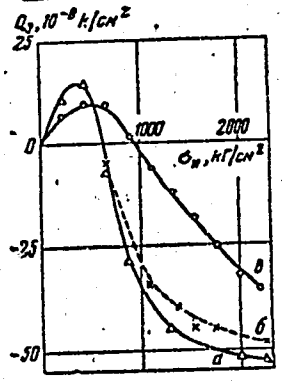


Fig. 4:

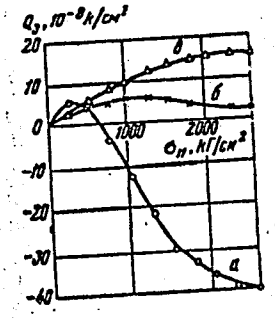
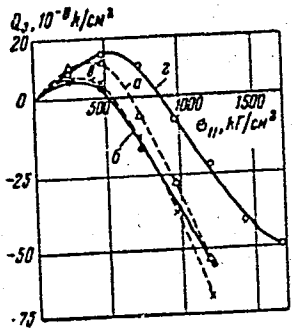


Fig. 5:



Card 9/9

BOGDANOV, S.V.; VUL, B.M.; RAZBASH, R.Ya.

Characteristic piezoelectric properties of ceramic piezoelements from $BaTiO_3$ cut out at an angle of 45° to the direction of polarization. Kristallografiia 6 no.2:271-273 Mr-Ap '61. (MIRA 14:9)

1. Fizicheskiy institut im. P.N.Lebedeva AN SSSR.
(Piezoelectricity) (Barium titanate)

39975
S/181/62/004/008/020/041
B102/B104

24.7700

AUTHOR: Bogdanov, S. V.

TITLE: The electrical strength of barium titanate

PERIODICAL: Fizika tverdogo tela, v. 4, no. 8, 1962, 2179 - 2183

TEXT: In contradistinction to several other investigators, Fang and Brower (Phys. Rev. 113, no. 2, 456, 1959) found that near the phase transition points (+120, 0, -70°C) where $BaTiO_3$ has ε-peaks the electrical strength E_s has minima. It was also found that E_s tends to decrease with increasing temperature. As the experimental method of Fang and Brower was not faultless the author repeated the $E_s(t)$ measurements (at +140, +120, +20, 0, -40 and -70°C where, according to them, E_s should have extrema) more adequately and more accurately (maximum error $\pm 11\%$). The results so obtained disagree with those of Fang and Brower, E_s being virtually temperature-independent and at the phase transition points somewhat higher rather than lower: at the temperatures stated above E_s(kv/cm) was 127,

Card 1/2

S/181/62/004/008/020/041
The electrical strength of barium titanate B102/B104

134, 127, 122, 123, 121. There are 4 figures and 1 table.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR Moskva
(Physics Institute imeni P. N. Lebedev AS USSR, Moscow)

SUBMITTED: March 22, 1962

Card 2/2

44145
S/181/62/004/010/035/063
B102/B112

24.2600

AUTHORS: Kopylovskiy, B. D., and Bogdanov, S. V.

TITLE: Effect of surface recombination on the phase shift between photoconductivity and the light exciting it

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2867 - 2872

TEXT: In continuation of an earlier paper (FTT, 3, 926, 1961) the authors investigate the relationship between the nonequilibrium carrier lifetime τ and the phase angle φ that gives rise to the photoconduction signal and the exciting light. As is known, φ is reduced by the surface recombination, which leads to a nonlinear frequency dependence of $\tan\varphi$. Without surface recombination $\tan\varphi = -\omega\tau$, while with surface recombination $\tan\varphi = -\omega\tau F(\alpha L_0, d/L_0, s, \omega)$; α is the light absorption coefficient, L_0 the diffusion length, d is the specimen thickness, s is the surface recombination rate, and ω is the light modulation frequency. $|F(....)| \leqslant 1$ and decreases with increasing arguments. The mechanism whereby surface recombination influences the frequency dependence of $\tan\varphi$ is still unexplained and is investigated here. Independently of the values assumed by α, d and L_0,

Card 1/2

Effect of surface...

$\tan \varphi/\omega\tau$ depends on the frequency only when $s=0$. This is proved. To explain the physical reason for this nonlinearity the variation of the time-dependent part of the excess carrier concentration (n_1) through the thickness of the sample thickness is studied for the case $\alpha L_0 \to \infty$. This change can be described by $n_1(x,t) = M(x,\omega)e^{j(\omega t-\varphi_0)}$ where $M(x,\omega)$ is a highly complex function. This relation describes the wave-type character of the propagation of the variable component of the excess carrier concentration; amplitude and phase of this "wave" depend on ω,τ,d, and x. The wavelength is proportional to $1/\omega$. As ω increases the excess carriers tend to become localized near the surface. If $s \neq 0$ this increases influence of the surface recombination and entails therefore a decrease of φ; i.e. if $s \neq 0$, $\tan \varphi/\omega\tau$ decreases with increasing ω. The entire complex of the surface recombination effects can be explained by the wave-type propagation of the surplus carriers into the specimen.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR, Moskva
(Physics Institute imeni P. N. Lebedev AN USSR, Moscow)

SUBMITTED: May 31, 1962

Card 2/2

24.7100

S/070/62/007/005/006/014
E132/E460

AUTHOR: Bogdanov, S.V.

TITLE: The influence of mechanical loading on the orientation of domains in single crystals of $BaTiO_3$

PERIODICAL: Kristallografiya, v.7, no.5, 1962, 755-760 + 1 plate

TEXT: Changes in the domain structure of single crystals of $BaTiO_3$ have been observed visually. The dynamics of these changes are examined and it is found that the reorientation of the domains can be either reversible or irreversible. For irreversibility it is essential that the "impulse" $p = st$ should exceed a certain critical value P_{crit}. This is explained qualitatively. No mechanical stress can reverse the direction of polarization as it corresponds to an extension along the polar axis but stress, for example s_{33}, can change the polar axis by 90°, for example from [001] to [100] or [010]. Previous experimental and theoretical investigations are reviewed and new observations are reported. A definite constant load F_{33} was applied to the crystal along the c-axis and a succession of photographs was taken of the domain structure which permitted the orientation to be followed in time. The crystal was then

Card 1/2

KOPYLOVSKIY, B.D.; BOGDANOV, S.V.

Effect of surface recombination on the phase shift between photoconductivity and the exciting light. Fiz.tver.tela 4 no.10:2867-2872 O '62. (MIRA 15:12)

1. Fizicheskiy institut imeni Lebedeva AN SSSR, Moskva.
(Photoconductivity)

BOGDANOV, S.V.

Effect of a mechanical load on the orientation of domains in $BaTiO_3$ single crystals. Kristallografiia 7 no.5:755-760 S-O '62. (MIRA 15:10)

1. Fizicheskiy institut imeni P.N.Lebedeva.
(Barium titanate crystals) (Strains and stresses)

BOGDANOV, S.V.; TODRES-SELEKTOR, Z.V.

Rearrangements in the series of hydroxy derivatives of bisulfited naphtho-1,2-furoxans. Zhur. VKHO 7 no.6:697-698 '62. (MIRA 15:12)

1. Nauchno-issledovatel'skiy institut organicheskikh poluproduktov i krasiteley.
(Naphthofuroxan)
(Hydroxy compounds)

BOGDANOV, S. V. , and KISELEVA, K. V.

"On the Nature of the Dielectric Properties of Solid Solutions of $SrTiO_3$ - $Bi_{2/3}TiO_3$."

report presented at the Symposium on Ferroelectricity and Ferromagnetism , Leningrad, 30 May - 5 June 1963

S/181/63/005/003/017/046
B102/B180

AUTHOR: Bogdanov, S. V.

TITLE: Ferroelectrical properties of materials and the nonlinearity of the dielectric polarization

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 807-810

TEXT: Nonlinearity of dielectrical polarization was sometimes assumed to be a specific property of a certain class of ferroelectrics, characterized by nonlinear field dependence of ε and by dielectric hysteresis loops (e. g. Nuovo Cimento, 13, 257, 1959). The author of the present paper shows that this nonlinearity is a more general property. For the usual "linear" dielectrics also, P(E) is a linear function only in weak fields. But even then $P = \alpha E + \beta E^3 + \ldots$, β being very small. Consequently, since $\varepsilon = 1 + 4\pi dP/dE$, $\varepsilon = 1 + 4\pi(\alpha + 3\beta E^2 + \ldots)$, i. e. at stronger fields ε and, of course, the capacitance also, will be field-dependent. Even in gases ε becomes field-dependent near breakdown voltages. Materials with relaxative polarizations (relaxators) which may reach very high ε-values show these nonlinearities at lower field strengths. The difference

Card 1/2

between ferroelectrics with nonlinear e(E) and other materials consists in the presence of terms which are odd in E: For a single-domain ferroelectric crystal $\varepsilon = 1+4\pi(\alpha+2\beta E+3\gamma E^2+\ldots\ldots)$. The term $2\beta E$ plays an important role for the dielectrical properties of the ferroelectric. For example, for $BaTiO_3$ β is negative and ε drops with increasing E when $\vec{E}$ is parallel to the spontaneous polarization. The nonlinearity is therefore a property of all materials only at relaxators it is especially marked and may be observed at lower field strengths. These materials have distorted dielectric loss ellipses, i. e. hysteresis loops without saturation of the polarization and without definite coercive fields and residual polarization.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR, Moskva
(Physics Institute imeni P. N. Lebedev AS USSR, Moscow)

SUBMITTED: October 8, 1962